IN THE CLAIMS

Claim 1 (withdrawn): A control system for controlling an apparatus which includes an actuator that has a movable member and that urges movement of the member in response to an actuator control signal, and which is operable to generate a digital position error signal representing an actual state of the member, said control system comprising:

a first control portion responsive to an input signal representing a target position of the member, and operable in response to the input signal to utilize a model reference control technique to generate a digital first control signal representing a movement of the member, and to generate a second control signal representing an expected response of the actuator to the digital first control signal;

a second control portion responsive to the digital position error signal, the digital first control signal, and the second control signal, and operable to generate in response thereto a digital third control signal representing a movement of the member;

a first digital to analog converter operable to convert the digital first control signal to an analog first control signal;

a second digital to analog converter operable to convert the digital third control signal to an analog third control signal; and

a junction responsive to the analog first control signal and the analog third control signal, and operable to generate the actuator control signal by combining the analog first control signal and the analog third control signal in a manner giving the analog first control signal greater weight than the analog third control signal.

Claim 2 (withdrawn): A control system according to Claim 1, wherein said first control portion includes:

a model reference of the actuator responsive to a feedforward control signal representing an operation to be effected by the actuator in order to place the member in the target position, and operable to generate a model control signal representing an expected response of the actuator to the feedforward control signal; and

a model reference control circuit responsive to the model control signal and the input signal representing the specified state of the actuator, and operable to generate the feedforward control signal in response to the model control signal and the input signal, wherein the feedforward control signal is a digital signal;

the first digital control signal being the feedforward control signal, and the second digital control signal being the model control signal.

Claim 3 (withdrawn): A control system according to Claim 1, wherein said second control portion includes:

a summing arrangement operable to receive the digital first control signal and the digital third control signal, and operable to generate a digital positioning signal by adding the digital first control signal and the digital third control signal in a manner giving the digital first control signal greater weight than the digital third control signal;

a state estimator responsive to the digital positioning signal and the digital position error signal, and operable to generate a state estimation signal representing an estimated state of the actuator;

a summing arrangement responsive to the second control signal and the state estimation signal, and operable to generate a state error signal by subtracting the state estimation signal from the second control signal; and

a control law responsive to receive the state error signal and operable to generate a correction control signal;

the digital third control signal being the correction control signal.

Claim 4 (withdrawn): A control system according to Claim 1, wherein the second control signal includes information representing an expected position of the member.

Claim 5 (withdrawn): A control system according to Claim 1, wherein the second control signal includes information representing an expected velocity of the member.

Claim 6 (withdrawn): A control system according to Claim 1, wherein the second control signal includes information representing an expected acceleration of the member.

Claim 7 (withdrawn): A control system according to Claim 1, wherein the second control signal includes information representing an expected position, velocity and acceleration of the member.

Claim 8 (withdrawn): A control system according to Claim 1, wherein the state estimation signal includes information representing an estimated position of the member.

Claim 9 (withdrawn): A control system according to Claim 1, wherein the state estimation signal includes information representing an estimated velocity of the member.

Claim 10 (withdrawn): A control system according to Claim 1, wherein the state estimation signal includes information representing an estimated acceleration of the member.

Claim 11 (currently amended): A control system for controlling a hard disk drive having a rotatably supported disk, a read/write head which is movable relative to the disk and which outputs an analog servo wedge signal read from the disk, and an actuator operable to urge movement of the read/write head relative to the disk in response to an analog positioning signal, said control system comprising:

a position-error-signal channel operable to generate an analog position error signal in response to the analog servo wedge signal;

an analog-to-digital converter circuit operable to convert the analog position error signal to a digital position error signal;

a digital signal processor operable to generate digital positioning information as a function of the digital position error signal, said digital signal processor ~~utilizing~~

determining a model reference control technique a after an initialization of said hard disk drive and

based on an expected response of the actuator to a feed forward control signal of said hard disk drive in generating the digital positioning information; and

a digital-to-analog converter operable to convert the digital positioning information into the analog positioning signal.

Claim 12 (original): A control system according to Claim 11, wherein the digital positioning information generated by said digital signal processor includes:

a digital first positioning signal component; and

a digital second positioning signal component; and

wherein said digital-to-analog converter includes:

a first digital-to-analog converter operable to convert the digital first positioning signal component into an analog first positioning signal component;

a second digital-to-analog converter operable to convert the digital second positioning signal component into an analog second positioning signal component; and

a summing arrangement operable to generate the analog positioning signal by combining the analog first positioning signal component and the analog second positioning signal component in a manner giving the analog first positioning signal component greater weight than the analog second positioning signal component.

Claim 13 (original): A control system according to Claim 11, further comprising:

a power amplifier operable to amplify the analog positioning signal to generate an amplified analog positioning signal which is applied to the actuator.

Claim 14 (original): A control system according to Claim 11, wherein said digital-to-analog converter and said digital signal processor are fabricated in a single piece of semiconductor material.

Claim 15 (original): A control system according to Claim 11, wherein said digital-to-analog converter circuit and said digital signal processor are fabricated in a single piece of semiconductor material which is silicon.

Claim 16 (original): A control system according to Claim 11, wherein said digital signal processor is further operable to utilize a state estimator technique in generating the digital positioning signal.

Claim 17 (original): A control system according to Claim 11, wherein said digital signal processor is further operable to utilize a control law in generating the digital positioning signal.

Claim 18 (original): A control system according to Claim 11, wherein the digital positioning information generated by said digital signal processor includes:

a digital first positioning signal component; and

a digital second positioning signal component;

said digital signal processor being operable to utilize said model reference control technique to generate the digital first positioning signal component; and

said digital signal processor being operable to utilize a state estimator technique to generate a state estimate signal in response to the digital positioning signal and the digital position error signal, and being operable to utilize a control law technique to generate the digital second positioning signal component in response to the state estimate signal and said model reference control technique;

said digital-to-analog converter including:

a first digital-to-analog converter operable to convert the digital first positioning signal component into an analog first positioning signal component;

a second digital-to-analog converter operable to convert the digital second positioning signal component into an analog second positioning signal component; and

a summing arrangement operable to generate the analog positioning signal by combining the analog first positioning signal component and the analog second

positioning signal component in a manner giving the analog first positioning signal component greater weight than the analog second positioning signal component.

Claim 19 (withdrawn): A method for controlling an apparatus which includes an actuator that has a movable member and that urges movement of the member in response to an actuator control signal, and which is operable to generate a digital position error signal representing an actual state of the member, said method comprising the steps of:

using a model reference control technique responsive to an input signal representing a target position of the member to generate a digital first control signal which represents a movement of the member, and to generate a second control signal which represents an expected response of the actuator to the digital first control signal;

generating a digital third control signal in response to the digital position error signal, the digital first control signal, and the second control signal, the digital third control signal representing a movement of the member;

converting the digital first control signal into an analog first control signal;

converting the digital third control signal into an analog third control signal; and

generating the actuator control signal by combining the analog first control signal and the analog third control signal in a manner giving the analog first control signal greater weight than the analog third control signal.

Claim 20 (withdrawn): A method according to Claim 19, wherein said step of using said model reference control technique includes the steps of:

generating a model control signal representing an expected state of the actuator in response to a feedforward control signal which represents an operation to be effected by the actuator in order to place the member in a target position; and

generating the feedforward control signal in response to the model control signal and the input signal, wherein the feedforward control signal is a digital signal;

the digital first control signal being the feedforward control signal, and the second control signal being the model control signal.

Claim 21 (previously presented): A method according to Claim 18 wherein said step of generating the digital third control signal includes the steps of:

generating a digital positioning signal by adding the digital first control signal and the digital third control signal in a manner giving the digital first control signal greater weight than the digital third control signal;

generating in response to the digital positioning signal and the digital position error signal a state estimation signal representing an estimated state of the actuator;

generating a state error signal by subtracting the state estimation signal from the second control signal; and

generating in response to the state error signal a correction control signal which is the digital third control signal.